REMARKS

This paper is being provided in response to the Office Action mailed February 11, 2004, for the above-referenced application. Applicant respectfully submits the following remarks and requests reconsideration in view thereof.

The rejection of claims 1-8 under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,191,416 to Dickson et al. (hereinafter "Dickson") in view of U.S. Patent No. 6,493,041 to Hanko et al. (hereinafter "Hanko") and further in view of U.S. Patent No. 6,069,602 to Tanaka et al. (hereinafter "Tanaka") is hereby traversed and reconsideration is respectfully requested.

Independent claim 1 recites a dot display type video display apparatus displaying an image having a first frame frequency at a second frame frequency that is lower than the first frame frequency. A synchronization signal generation circuit generates a synchronization signal of the second frame frequency. A conversion frequency detector calculates a number of frames making up a unit block at each of the frame frequencies and a number of frames to be thinned based on the first frame frequency and the second frame frequency. A frame memory stores a first frame having the first frame frequency. A difference detector compares intensity data of each dot of a second frame which is currently input to the video display apparatus with intensity data of each dot of the first frame which is stored in the frame memory immediately before the second frame and detects a difference between the two frames. A difference adder counts a number of dots for a case in which the difference of the intensity data detected by the difference detector is greater than a prescribed value. A movement detection/judgment section

distinguishes whether or not a count value detected by the difference adder is below a prescribed value and outputs a signal indicating that thinning of the second frame is possible, when the count value of the difference adders if below the prescribed value. A frame thinning section is included for thinning the second frame in a case in which the signal indicating that frame thinning of the frame is possible is output from the movement detection/judgment section and also a signal indicating the number of frames to be thinned is output from the conversion frequency detector. Further, the second frame is a selected and determinate frame, and the selection of said second frame for thinning by said frame thinning section is based on said signal indicating that thinning of said second frame is possible and said signal indicating said number of frames to be thinned, whereby occurrence of non-continuities in said image when displayed at said second frame frequency is reduced. Claims 2-5 depend directly or indirectly on independent claim 1.

Independent claim 6 recites a dot display type video display apparatus having substantially the elements as in claim 1, including a frame thinning section as described above and further including a frame thinning stopping section. The frame thinning stopping section stops the frame thinning operation of the frame thinning section within a current block including the first frame and the second frame. The stopping occurs in a case in which, if, as a result of an execution of frame thinning by the frame thinning section, a total number of thinned frames has reached the number of frames to be thinned which is output from the conversion frequency detector. Further, the second frame is a selected and determinate frame, and the selection of said second frame for thinning by said frame thinning section is based on said signal indicating that thinning of said second frame is possible and said signal indicating said number of frames to be

thinned, whereby occurrence of non-continuities in said image when displayed at said second frame frequency is reduced.

Independent claim 7 recites a plasma display apparatus displaying an image having a first frame frequency and a second frame frequency that is lower than the first frame frequency. The apparatus substantially includes the elements as described above with respect to claims 1 and 6, up to and including a frame thinning stopping section. Further, the frame thinning of said second frame is performed irrespective of a positional order of said second frame in said unit block.

Independent claim 8 recites a display method for a dot display type video display apparatus having elements as described with respect to claim 1, including a frame thinning section as described above. The method includes the step of comparing the intensity data of the first frame with that of the second frame. The second frame is thinned when the intensity data of the two frames are the same. The frame thinning operation is stopped within a current block including the first frame and the second frame. The stopping operation occurs in a case in which, as a result of an execution of frame thinning, a total number of thinned frames has reached the number of frames to be thinned, which is output from the conversion frequency detector. Further, the second frame is a selected and determinate frame, and the selection of said second frame for thinning by said frame thinning section is based on said signal indicating that thinning of said second frame is possible and said signal indicating said number of frames to be thinned, whereby occurrence of non-continuities in said image when displayed at said second frame frequency is reduced.

The Dickson reference discloses an image processing system for converting a convention low-resolution video signal to a format suitable for transfer to high-resolution film, while preserving the realistic effects of any motion represented in the original video signal. Interpolation and comparison of video fields are utilized to generate background frames by the interlacing of original fields as controlled by difference information determined between interpolated fields. (See Abstract, Figure 4 and col. 7, line 65-col. 8 line 26 of Dickson).

The Hanko reference discloses a method and apparatus for detection motion in video in which frames from an incoming video stream are digitized and compared with a reference frame. In comparing a current frame with the reference frame, a difference count for the current frame generated by a pixel difference counter is compared to the motion detection criteria used by the system to determine whether motion has occurred. A new reference frame is determined upon the occurrence of the first frame for which no motion has been detected after a frame for which motion has been detected. A motion floor value is recalculated based on the amount of motion exhibited in the current frame, the pixel difference counter is zeroed, and processing begins again by digitizing the next frame of a video stream. (See Abstract, Figure 4, and col. 10, lines 18-46 of Hanko).

The Tanaka reference discloses a liquid crystal display device and driving method. The Office Action cites Tanaka as disclosing frame thinning of a second frame of CPU produced image data or externally supplied data. (See col. 12, lines 36-65 of Tanaka.)

Applicant provides an example of frame thinning as known in the prior art in which a fifth frame is mechanically thinned as compared with the frame thinning process that is provided by the present invention. As stated by Applicant, the prior art discloses a frame thinning process in which an indeterminate frame is selected for thinning, i.e. the fifth frame every time (see Figs. 3a – 3c), and discarded whenever thinning takes place regardless of the content of the frame. For example, as shown in Figs 3a – 3c, a frame conversion process (to a video signal) adds a frame B' that is the same frame of B. When the five frames are thinned, however, the fifth frame (frame D) is discarded regardless of the fact that frame B' is a duplicate frame. The frame thinning of the prior art depends on a particular timing and is not based on a signal from a movement detection section or a signal from a conversion frequency detector that determines the number of frames to be thinned. (See page 10, lines 1-23 of the present application).

In contrast, in the present claimed invention, frame thinning is based on a signal indicating that thinning of a frame is possible and a signal indicating the number of frames to be thinned (see Fig. 3(d) of the present application). In accordance with the two different vertical synchronization frequencies, the number of frames in one block required for vertical frequency conversion can be judged to be five frames before conversion and four frames after conversion, respectively, enabling calculation of the number of frames to be thinned. Because it is possible from the information of the movement detection/judgment section to judged that there is little movement information between frame B and frame B', the movement detection/judgment section outputs to the frame thinning section a signal, which indicates that it is possible to thin the frame B', and the frame thinning section, based on the signal from the movement detection/judgment section and the signal from the conversion frequency detector, which indicates the number of

frames to be thinned, executes processing for thinning the frame B'. In this specific example, because the number of frames to be thinned in one block is one frame, by stopping further frame thinning within this block, it is possible to reproduce a moving image continuously, with the sequence A → B → C → D. (See page 10, line 24 to page 11, line 16 of the present application).

Applicant's independent claims 1, 6 and 8 recite at least the features of a video display apparatus that includes a conversion frequency detector and a movement detection/judgment section that output signals to control thinning, and wherein frame thinning selection *is based on the signal indicating that thinning of said second frame is possible and the signal indicating said number of frames to be thinned, whereby occurrence of non-continuities in said image when displayed at said second frame frequency is reduced.* As described above with respect to Figure 3 of Applicant's specification, Applicant's claimed invention allows a selected and determinate frames to be thinned based on indicating signals that determine whether thinning is possible and the number of frames to be thinned. As recited in claim 7, *the frame thinning of said second frame is performed irrespective of a positional order of said second frame in said unit block.*

Applicant respectfully submits that neither Dickson, Hankó nor Tanaka, taken alone or in combination, teach or suggest at least the above features as claimed by Applicant. Specifically, Dickson discloses a procedure for interpolating multiple fields from original fields. The multiple fields are compared with one another and for each pixel in the entire frame, the difference between an original pixel from one field and an interpolated pixel from the other field is generated. Dickson discloses *discarding every fifth field regardless of its content and without*

any other input to yield two fields for each original film frame. (See col. 6, lines 6-11 of Dickson). Dickson does not base the discarding of the fifth field on any indicating signals.

Hanko discloses the use of reference frames to compare with frames in which motion has been detected according to motion detection criteria. Upon the occurrence of a new frame having no motion detected after a frame for which motion has been detected, that frame is stored as a new reference frame that is then utilized for subsequent comparisons. (See Hanko, col. 10, lines 31-41). Hanko does not disclose any frame thinning corresponding to a motion detection/judgment signal and a conversion frequency signal to reduce the occurrence of non-continuities in a moving image.

Further, the Office Action cites Tanaka as disclosing frame thinning that is accomplished at a second frame of CPU produced image data or externally supplied data. However, Tanaka does not teach or suggest frame thinning that is performed *based on said signal indicating that thinning of said second frame is possible and said signal indicating said number of frames to be thinned*, as is claimed by Applicant. Tanaka's frame thinning is performed in a specified order. For example, in the Second Embodiment (beginning on col. 12, line 10 of Tanaka), Tanaka discloses a frame thinning process in which one frame is stored (first frame), two frames are discarded (second and third frames), one frame is stored (fourth frame) etc... (See col. 12, lines 59-64 of Tanaka.) The frame thinning is not performed based on a signal indicating the possibility of frame thinning (as provided by a movement detection/judgment section) and a signal indicating the number of frames to be thinned, as is the case with Applicant's claimed

invention. The specified order and the number of frames to be thinned is fixed beforehand in Tanaka.

Similarly, in Tanaka's Third Embodiment (beginning at col. 15, line 10 of Tanaka), a thinning process is disclosed in which the problem of "frame loss" (image flickering) is addressed but in which the resulting solution of Tanaka is for *every frame of a video signal to be stored and thinned.* (See col. 15, lines 14-20 of Tanaka.) No frame thinning determinations are based on a signal output from a movement detection section and a signal output from a conversion frequency detector concerning the number of frames to be thinned, as in Applicant's claimed invention.

Applicant respectfully submits that neither Dickson, Hanko nor Tanaka, taken alone or in any combination, teach or fairly suggest at least the features recite at least the features of a video display apparatus that includes a conversion frequency detector and a movement detection/judgment section that output signals to control thinning, and wherein frame thinning selection *is based on the signal indicating that thinning of said second frame is possible and the signal indicating said number of frames to be thinned, whereby occurrence of non-continuities in said image when displayed at said second frame frequency is reduced* or *the frame thinning of said second frame is performed irrespective of a positional order of said second frame in said unit block.* Accordingly, Applicant respectfully requests that the rejection of the claims be reconsidered and withdrawn.

Based on the above, Applicant respectfully requests that the Examiner reconsider and withdraw all outstanding rejections and objections. Favorable consideration and allowance are earnestly solicited. Should there be any questions after reviewing this paper, the Examiner is invited to contact the undersigned at 617-248-4038.

Respectfully submitted,
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